Early Life Circumstance and Adult Mental Health Adhvaryu, Fenske and Nyshadham, *JPE* (2019)

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Overview

- **Question:** How do childhood circumstances affect mental health as an adult?
- **Approach:** Diff-in-Diff, look at cocoa producing regions in Ghana.
- **Why it's special:** Mediation is really cool; can use Rodrigo's research to extend a basic diff-in-diff and get your paper published in the *JPE*.

Setting—Mental Health

- How does circumstance in early life affect psychological distress in adulthood?
- Depression generates losses of about 55.5 million DALYs in low- and middle-income countries.
- Use Kessler Psychological Distress Scale (K10); index of anxiety-depression mental distress

Setting—Cocoa in Ghana

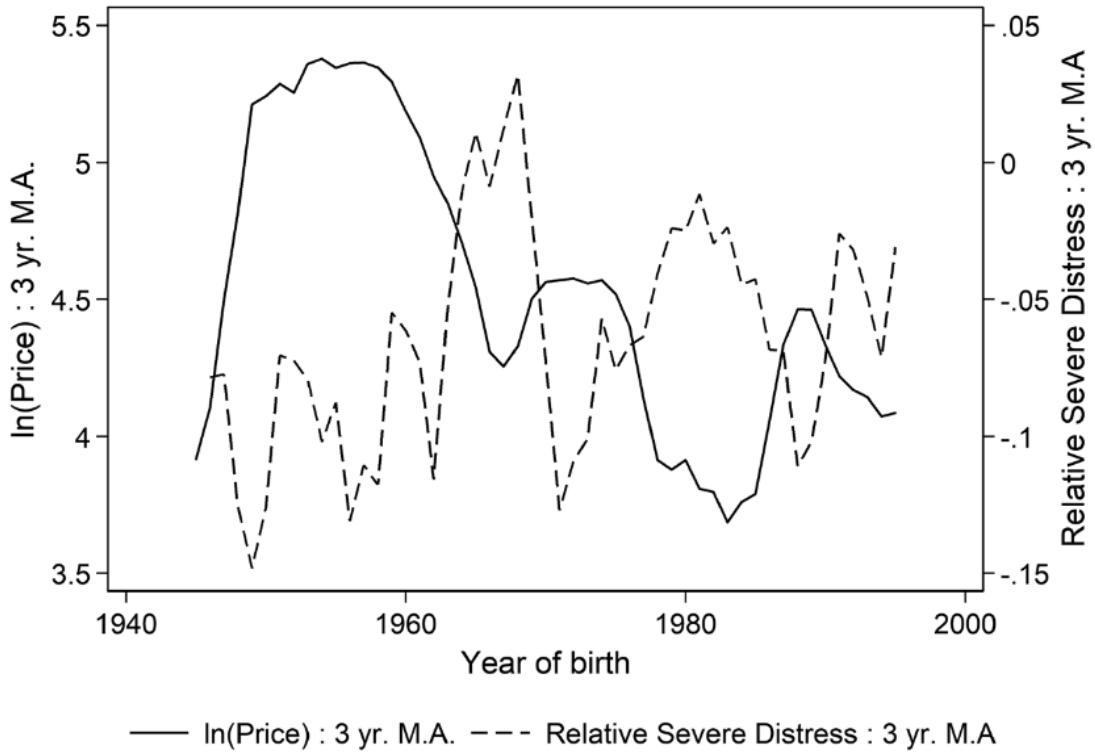

FIG. 1.—Cocoa prices at birth and severe distress

- Households in the cocoa-producing regions of Ghana experience changes in the real producer price of cocoa as income shocks
  - Households in regions that do not produce cocoa are unaffected

Setting—Cocoa in Ghana

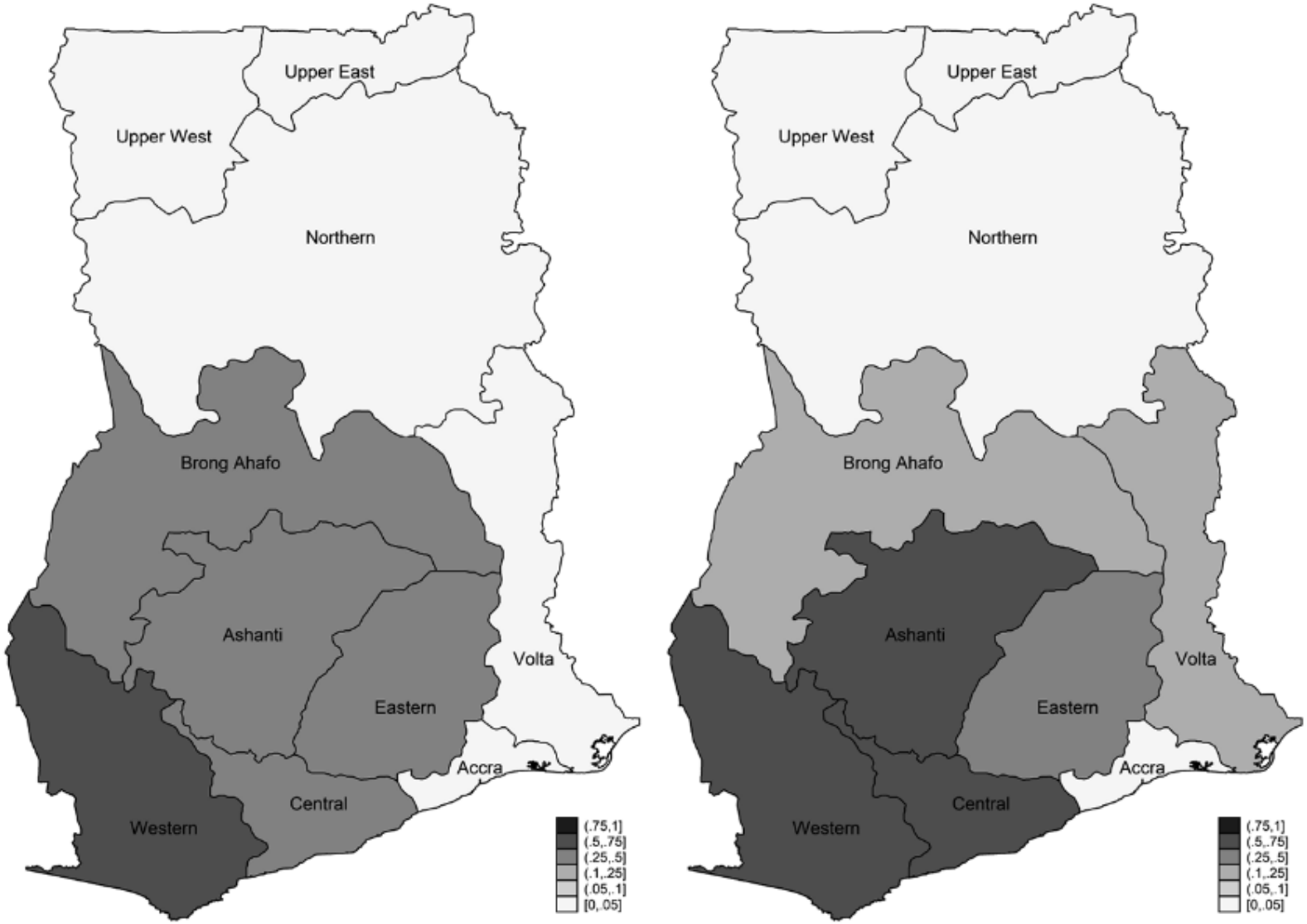

FIG. 2.—Cocoa production and cocoa-suitable soils by region. The figure on the left depicts the fraction of land in the EGC-ISSER survey planted to cocoa in each region. The figure on the right depicts the share of all land in the region that is suitable for cocoa.

Setting—Cocoa in Ghana

FIG. 3.—Mean K10 score and severe distress by region of birth. The figure on the left depicts the mean K10 score over individuals in the sample. The figure on the right depicts

Empirical Strategy

- Children born to households in cocoa-growing regions during periods of high cocoa prices will have more resources
  - Could have large impacts on mental health later in life

$$\text{Outcome}_{irt} = \alpha + \beta \ln(\text{Cocoa Price}_t) \times \text{Cocoa Producer}_r + x'_{irt}\gamma + \delta_r + \eta_t + \epsilon_{irt}$$

- Outcome_{irt} is the outcome for individual i in region r, year t
  1. Natural log of individual's response on Kessler Psychological Distress Scale
  2. Dummy for whether the score was 30 or above

TABLE 1
SUMMARY STATISTICS

	Mean (1)	Standard Deviation (2)	Minimum (3)	Maximum (4)	Observations (5)
Mental health:					
ln K10	2.92	.31	2.30	3.91	7,815
Severe distress	.074	.26	0	1	7,815
Cocoa price shocks:					
ln(cocoa price) × region any cocoa: year of birth	3.30	2.01	0	5.52	7,741
Controls:					
Female	.55	.50	0	1	7,815
Year of birth	1973	13.7	1943	1997	7,815
Head	.49	.50	0	1	7,815
Female × head	.15	.36	0	1	7,815
Real producer price series (1943–97):					
Real cocoa price	105	60.1	31.1	251	55
ln(cocoa price)	4.50	.55	3.44	5.52	55
Fraction of farm area under cocoa, by region (%):					
Ashanti	44.36				
Brong Ahafo	31.80				
Central	34.51				
Eastern	26.20				
Greater Accra	.09				
Northern	.00				
Upper East	.00				
Upper West	.00				
Volta	4.38				
Western	53.95				

SOURCE.—EGC-ISSER Socioeconomic Panel Survey and Teal (2002).

Results (highlights)

- Higher cocoa prices reduce mental distress; robust across specifications
- One SD price shock decreases severe mental distress by 3 percentage points (almost half the mean)
- Estimates from logit specification are about half as large as the results from the LPM
  - Still statistically significant, and still large relative to baseline

Results—K10 Outcomes

TABLE 2
IMPACTS OF YEAR OF BIRTH: PRICE SHOCK ON MENTAL DISTRESS

	ln(K10)			Severe Distress			Severe Distress (Logit Marginal Effects)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Price shock (YOB)	−.023	−.045**	−.045**	−.052***	−.061***	−.062***	−.021**	−.033***	−.031**
	(.016)	(.022)	(.022)	(.016)	(.022)	(.022)	(.010)	(.013)	(.012)
Standard errors clustered by:									
ROB	(.021)	(.016)	(.016)	(.005)	(.014)	(.013)			
YOB	(.012)	(.019)	(.018)	(.013)	(.018)	(.019)			
Cameron et al.: enumeration area and YOB	(.014)	(.020)	(.019)	(.013)	(.019)	(.020)			
Cameron et al.: ROB and YOB	(.021)	(.019)	(.019)	(.005)	(.021)	(.018)			
Moulton: ROB	(.015)	(.020)	(.020)	(.013)	(.018)	(.018)			
Moulton: YOB	(.015)	(.020)	(.020)	(.013)	(.018)	(.018)			
Wild cluster bootstrap	(.019)	(.025)	(.027)	(.027)	(.034)	(.034)			
Observations	7,741	7,741	7,741	7,741	7,741	7,741	7,740	7,740	7,710
YOB fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROB fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROB trends	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Controls	No	No	Yes	No	No	Yes	No	No	Yes
Outcome mean: noncocoa regions	3.04	3.04	3.04	.12	.12	.12	.12	.12	.12
Outcome mean: cocoa regions	2.88	2.88	2.88	.060	.060	.060	.060	.060	.060

NOTE.—Standard errors clustered by enumeration area are in parentheses, unless otherwise indicated. Number of enumeration areas per region ranges between 12 and 60. All regressions are ordinary least squares (OLS). Controls are female, head, female × head, ethnicity dummies, and religion dummies, unless otherwise indicated. YOB indicates year of birth (accounts for both nonlinear trends in unobservables at the country level and well-established associations between age at survey and mental health). ROB indicates region of birth.

* Significant at 10 percent.
** Significant at 5 percent.
*** Significant at 1 percent.

Mediation Analysis

- Methodology from Heckman, Pinto, Savelyev (2013)
- Application of inverse probability weighting from Huber (2014)
- Three key assumptions:
  1. Conditional independence of treatment (same as main identifying assumption)
  2. Conditional independence of mediator (may be violated; that's why they use inverse probability weighting)
  3. Common support (no mediator perfectly predicts treatment)
- Don't have enough data to deal with measurement error
- N.B. chose inverse probability weighting after looking at multiple approaches from Huber (2016); inverse probability weighting worked the best

Mediation Analysis

Potential Mediators:

1. Cash savings
2. Physical assets
3. Self-employment
4. English literacy
5. BMI
6. Height

- These mediators account for 10% of the total treatment effect.

- Remaining treatment effect is either the direct effect, or mediated by something outside the data set.

Mediation Analysis

TABLE 5
IMPACTS OF YEAR OF BIRTH PRICE SHOCKS (BINARY) ON ADULT OUTCOMES AND THEIR CONTRIBUTION TO TOTAL TREATMENT EFFECTS

	ln(K10) (1)	Severe Distress (2)	Cash Savings (3)	Physical Assets (4)	Self-Employed (5)	Literacy (6)	Height (7)	BMI (8)
Binary shock × cash savings	−.0220***	−.0243***						
	(.0067)	(.0058)						
Binary shock × physical assets	.0013	.0045						
	(.0087)	(.0074)						
Binary shock × self-employed	−.0659***	−.0658***						
	(.0244)	(.0226)						
Binary shock × literacy	−.0301	−.0219						
	(.0263)	(.0222)						
Binary shock × BMI	.0011	−.0086						
	(.0113)	(.0117)						
Binary shock × height	−.0056	.0070						
	(.0110)	(.0096)						
Binary price shock (YOB)	.0922	−.0838	.0552	.0880	.0650**	.0284	.0855	−.0255
	(.2235)	(.2012)	(.0855)	(.0874)	(.0308)	(.0363)	(.0729)	(.0547)
Observations	7,324	7,324	7,324	7,324	7,324	7,324	7,324	7,324
	Total Treatment Effect							
Binary price shock (YOB)	−.0638**	−.0573**						
	(.0251)	(.0263)						
Percent contribution to total effect on ln(K10)			1.9055	−.1810	6.7090*	1.3386	.7447	.0425
			(.2865)	(.9425)	(.0805)	(.261)	(.326)	(.4625)
Percent contribution to total effect on severe distress			2.3423	−.6976	7.4688*	1.0855	−1.0475	−.3818
			(.29)	(.8165)	(.0785)	(.2595)	(.2685)	(.358)
Observations	7,324	7,324						
Outcome mean	2.92	.074						
Additional regressors	YOB and ROB fixed effects; ROB trends; controls							

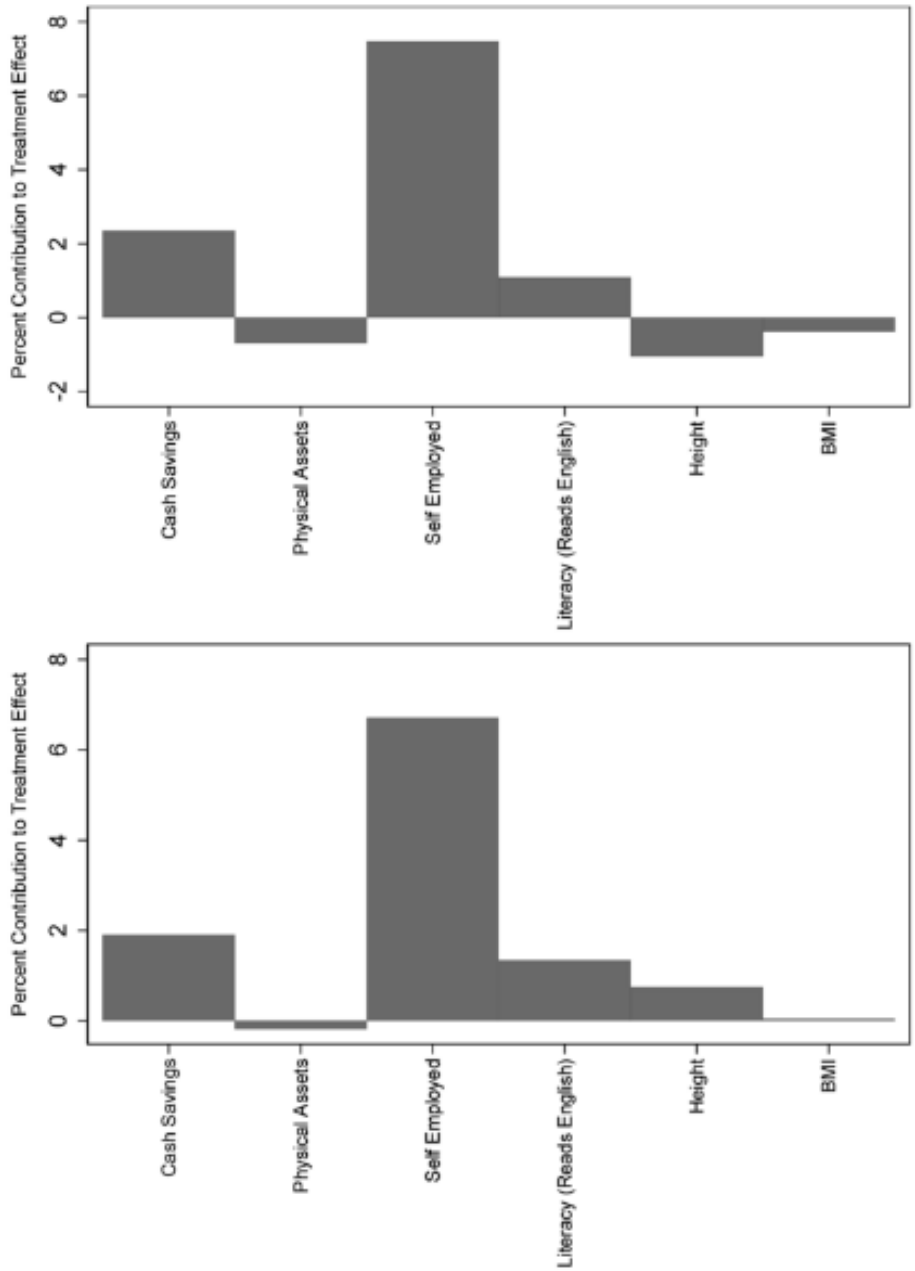

FIG. 4.—Mediation analysis. This figure depicts contributions of mediating factors to total treatment effects as calculated from regression results reported in table 5. The methodology for conducting this mediation analysis follows a special case of the procedure presented in Heckman et al. (2013) along with an application of inverse probability weighting developed in Huber (2014) to address concerns of endogeneity in the mediating variables.

Other Mechanisms

- Parental weight and BMI are improved by contemporaneous positive cocoa price shocks
- Positive (but imprecise) estimates for labor force participation, and substantial impacts on agricultural self-employment
- Authors interpret this as supporting evidence that impacts on mental health are coincident with improved labor, education and economic outcomes
- These estimates come from alternative datasets and cannot be included in a proper mediation analysis

Other Mechanisms

TABLE 6
OTHER ADULT OUTCOMES, MATERNAL HEALTH, AND INVESTMENT RESPONSES (DHS and Ghanaian Census)

	(1)	(2)	(3)	(4)	(5)
	Early Life Investments (DHS: Child Recode)				
	No. of Polio Doses Received	No. of DPT Doses Received	Received Measles Vaccination	No. of Total Vaccinations	Months of Breast-Feeding
Price shock (YOB)	.218**	.317***	.034	.528***	.989*
	(.076)	(.063)	(.054)	(.137)	(.511)
Observations	11,903	11,829	11,809	11,725	13,134
Outcome mean	2.25	2.24	.65	5.14	14.9
	Prenatal and At-Birth Investments (DHS: Child Recode)				
	Prenatal Doctor Visit	Received BCG Vaccination	Received Polio 0 Dose	Home Delivery	Doctor Attended Delivery
Price shock (YOB)	.085*	−.034	−.010	.028	−.017
	(.042)	(.042)	(.107)	(.066)	(.021)
Observations	9,582	11,886	9,067	11,101	11,090
Outcome mean	.22	.85	.49	.55	.073
	Maternal Health (DHS: Individual Recode)			Occupation (DHS: Individual Recode)	
	Weight (No Outliers)	BMI (No Outliers)		Not Working (DHS)	Agricultural Self-Employment
Price shock (YOB)				−.036	.065***
				(.021)	(.008)
Contemporaneous price shock	3.538***	1.044***			
	(.861)	(.319)			
Observations	14,411	14,022		19,831	19,831
Outcome mean	57.5	22.5		.23	.294
	Other Outcomes (Ghanaian Census: 2000 and 2010)				
	Dwelling Has Electricity	Dwelling Has Piped Water	Speaks English	Literate	Years of Schooling
Price shock (YOB)	.011**	.012**	.015***	.017***	.462***
	(.005)	(.005)	(.005)	(.005)	(.048)
Observations	2,367,613	2,367,687	2,410,404	2,410,404	2,410,407
Outcome mean	.55	.43	.63	.68	6.51
Additional regressors	YOB and ROB fixed effects; ROB trends; controls				

Conclusion

- Cocoa price shocks generate income shocks for Ghanaian families
- Use diff-in-diff to see how cocoa producers benefit from this additional income
- The authors go beyond this—mediation analysis to figure out what mechanisms are accounting for the results from the diff-in-diff
- Mechanisms in the mediation analysis can only explain 10% of the treatment effect
- Use additional data to investigate other mechanisms (but can't include these in mediation analysis)